



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Dynamic Chemical Loads as a Function of Land-Use Changes in a Watershed

Focus Categories: NPP, WQL, MOD

Keywords: Fertilizers, Nutrients, Pesticides, Toxics, Buffer Strips, Contaminant Transport, Decision Models, Land Use, Landscape Management, Land-Water Interactions, TMDL, Water Quality Modeling, Watershed Management

Duration: 9/2000 to 8/2002

Federal Funds Requested: \$ 41,937

Matching Funds Pledged: \$ 42,098

Principal Investigators: Arturo A. Keller

Bren School of Environmental Science & Management

University of California, Santa Barbara, CA 93106

Congressional District: 22nd.3

Abstract

The development of Total Maximum Daily Loads (TMDLs) is a pressing issue for the State Water Quality Control Board, Regional Water Quality Control Boards (RWQCB), local agencies, stakeholders in the watershed, and of course the U.S. Environmental Protection Agency (USEPA). The magnitude of the task is daunting, given the large number of TMDLs that have to be developed, nationally and even just statewide. As recent experience has shown, developing TMDLs is a complex matter, not only from the scientific perspective, but also from the more complex socioeconomic perspective. To increase the complexity, TMDLs have to take into account projected land-use changes.

The project will focus on the Santa Ana River Basin in Southern California, based on (1) high quality data on land-use, hydrology and water quality, since it is also the focus of a USGS NAWQA study; (2) major water quality issues, since this watershed has been extensively developed; and (3) the watershed will continue to experience major land-use changes in the next decades. To decrease the impact on the Santa Ana River, its tributaries and the coastal ecosystems, Best Management Practices (BMPs) need to be identified for the various existing and projected land-uses and factored into the development plans. Given the complexity of the system, sophisticated modeling tools are needed for addressing land-use changes in the Santa Ana River Basin.

The proposed research project will address the issue of land-use changes directly, using a watershed-scale modeling framework that has been developed by USEPA and TetraTech (BASINS), as well as a similar framework developed by the Electric Power Research Institute (EPRI) and Systech Engineering, Inc., denominated the Watershed Analysis Risk Management Framework (WARMF). Although very similar in their conceptual models, these two frameworks differ in their implementation, degree of user friendliness and the tools available to the users for developing TMDLs. In addition, to our knowledge there has not been a side-by-side comparison of these two frameworks on the same watershed at essentially the same resolution and with the exact same initial and boundary conditions; we believe such a comparison is vital for policymakers and stakeholders who will use these frameworks in the future. Both of these tools allow the implementation of changing land-use scenarios over time, and can be adapted to consider BMPs.

The specific objectives are: (1) implement the BASINS and WARMF models for the Santa Ana River watershed; (2) develop temporally-variable response functions for the various subcatchments in the watershed, correlating chemical load with a number of subcatchment characteristics as well as external driving forces; (3) investigate the effect of projected land-use changes on chemical loading and water quality; (4) determine the effect of BMPs on chemical loading and water quality; and (5) develop a methodology, for characterizing other watershed where TMDLs will be developed, which systematically analyses the role of land-use and BMPs. We will coordinate closely with the USGS NAWQA study, through direct exchange throughout the project of data sets, intermediate and final products.

The expected results of this project include the calibrated watershed modeling frameworks, which can be used by regulators and stakeholders in this basin, the well-characterized response functions of each subcatchment, which will be key in the development of TMDLs that consider land use changes and management practices, and a generalized methodology for characterizing watershed with multiple land-uses and management practices. In addition, there will be a substantial training component in this project, with participation of USGS NAWQA personnel..4